

Work Order ID 84664

May-30-12 3:53:00 PM

Duplicate

\*84664\*

U/R

Page 1

Item ID: D350-748-141TRN

Accept

\*N900040100\*

Setup

Start

\*NS1\*

Revision ID: U/R

Item Name: Crosstube Turning Detail

Stop

\*NS2\*

Start Date: 17/05/2012 Start Qty: 1.00 \*1\*

Cust Item ID:

Required Date: 22/05/2012 Req'd Qty: 1.00 \*1\*

Customer:

Reference:

Approvals: Process Plan: MLJ

Date: 12/05/31 Tooling:

Date:

Run Start

\*NR1\*

QC:

Date: SPC (Y/N):

Date:

Stop

\*NR2\*

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
--------------------------------	--------------------------	----------------------	---------	--------	--------------	---------------	---------------	------------------	----------------

Draw Nbr	Revision Nbr								PTO
----------	--------------	--	--	--	--	--	--	--	-----

D350-748-141 F U/R OK 9/12.05.24

100

\*100\*

MORI SEIKI CNC LATHE LARGE

0.00

1 0

Mori L  
12/09/24

Mori Seiki

Mori Seiki CNC Lathe Large

Memo

0.00

1-Fill tube with sand & install plugs on both ends as per Folio FA648

2-Turn first side as per Folio FA648

3- File transition lines smooth.

FOLIO REV: A/E

DWG REV: E

110

QC1- Inspect dimensions to dimension sheet

0.00

1 0

Mori L  
12/09/24

\*110\*

QC

Quality Control

5/20

W/O: 84664

## WORK ORDER CHANGES

DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: D350-748-141TR PAR #: Fault Category: X-tube NCR: Yes No DQA: *[Signature]* Date: 12/12/21

Resolution: Disposition: WO-W-12-i) QA: N/C Closed: *[Signature]* Date: 12/12/21

WORK ORDER NON-CONFORMANCE (NCR)								
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			
12/9/26	100	ULTRASOUND Deviation over tolerance. tol = 0.030" measured = 0.033"	DAS 12 8-89 12/9/26	Acceptable Min. wall OK	DAS 12 8-89 12/9/26	JK	DAS 12 8-89 12/9/26	(DAS) 16 9-89 (2013)

NOTE: Date &amp; initial all entries

**Work Order ID 84664**

May-30-12 3:53:00 PM

**\*84664\***

Page 2

Item ID: D350-748-141TRN

Accept

Revision ID: U/R

**\*N900040100\***

Setup Start

**\*NS1\***

Item Name: Crosstube Turning Detail

Stop

**\*NS2\***Start Date: 17/05/2012 Start Qty: 1.00 **\*1\***

Cust Item ID:

Required Date: 22/05/2012 Req'd Qty: 1.00 **\*1\***

Customer:

Reference:

Approvals:	Process Plan:	Date:	Tooling:	Date:	Run	Start	<b>*NR1*</b>
	QC:	Date:	SPC (Y/N):	Date:		Stop	<b>*NR2*</b>

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
120 <b>*120*</b> Mori Seiki	MORI SEIKI CNC LATHE LARGE  Mori Seiki CNC Lathe Large  Memo 1-Turn second side as per Folio FA648 2- File transition lines smooth. 3-Scribe Part & Batch as per Dwg D350-748-141 FOLIO REV: <u>M</u> DWG REV: <u>F</u>	0.00				1	0		KC - 12-9-25
130 <b>*130*</b> QC Quality Control	QC1- Inspect dimensions to dimension sheet  Memo QC8- Inspect parts - second check	0.00				1	0		KC - 12-9-25
140 <b>*140*</b> QC Quality Control	Memo	0.00				JW	0	12-9-26	

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

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NOTE: Date & initial all entries



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NOTE: Date & initial all entries



W/O:		WORK ORDER CHANGES					
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NOTE: Date & initial all entries

**Work Order ID 84664**

May-30-12 3:53:00 PM

**\*84664\***

Page 5

Item ID: D350-748-141TRN

Accept

Revision ID: U/R

Item Name: Crosstube Turning Detail

Start Date: 17/05/2012 Start Qty: 1.00

**\*1\***

Required Date: 22/05/2012 Req'd Qty: 1.00

**\*1\*****\*N900040100\***

Setup

Start

**\*NS1\***

Stop

**\*NS2\*****Reference:**

Approvals: Process Plan:

Date:

Tooling:

Date:

Run

Start

**\*NR1\***

QC:

Date:

SPC (Y/N):

Date:

Stop

**\*NR2\***Sequence ID/  
Work Center ID  
200**\*200\***

QC

Quality Control

Operation  
Description  
QC21- Final Inspection - Work Order ReleaseSet Up/  
Run Hours  
0.00

Tool ID

Tool #

Plan  
CodeAccept  
QtyReject  
QtyReject  
NumberInsp.  
Stamp

12/12/1808

Memo

0.00

U12.12.18

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

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DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

NOTE: Date & initial all entries

**Picklist Print**

May-30-12 3:53:05 PM

Page 1

Work Order ID: 84664

**\*84664\***  
**\*D350-748-141TRN\***

Parent Item: D350-748-141TRN  
Parent Item Name: Crosstube Turning Detail

Start Date: 17/05/2012

Required Date: 22/05/2012

Start Qty: 1.00

Required Qty: 1.00

**Comments:**

IPP Rev:A New Issue 08-03-06 DD verified by:ec  
 IPP Rev B Removed polish 08.04.02 EC verified by : DD  
 IPP Rev C Remove LPS-3 08.06.23 EC verified by DD IPP Rev C  
 11.02.24 as per dwg rev.F DD verf: JLM

Component Item ID/ Item Name	Replacement Item ID	Mfg/ Purch	Bin Item	Primary Location	Last Location	Route Seq ID	Unit of Measure	Qty on Hand	Qty per Kit	Total Qty	Qty Issued	Date Issued	Status
D6015-125		Manufactured	No			110	Each	38.0000	1	1		**	

**\*D6015-125\***

Crosstube Material

<u>Location</u>	<u>Loc Qty</u>	<u>Loc Code</u>
HALL	38	
61380	4	
72511	34	

mmr 12/09/22

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_  
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DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

NOTE: Date &amp; initial all entries

DART AEROSPACE LTD	Work Order:	84664
Description: Crosstube Assembly (AS350/355 High Fwd)	Part Number:	D350-748-141
Inspection Dwg: D350-748-141 Rev: F		Page 1 of 1

### FIRST ARTICLE INSPECTION CHECKLIST

Inspection Sheet Drawing Dimension	Tolerance	Actual Dimension	Accept	Reject	Method of Inspection	Comments
SIDE A	2.240	+0.005/-0.000	2.242.		VER/NMIC	CNC-04
	2.180	+0.005/-0.000	2.182.			
	2.180	+0.005/-0.000	2.184			
	2.237	+0.005/-0.000	2.241			
	2.272	+0.005/-0.000	2.276			
	2.306	+0.005/-0.000	2.310			
	2.339	+0.007/-0.000	2.346			
	2.339	+0.007/-0.000	2.346			
	0.062	+/-0.010	.062			
	4.26	+/-0.030			↓	↓
	R0.063	+/-0.010	.063		R6	—
	R0.50	+/-0.030	.50		R6	—
SIDE B	2.240	+0.005/-0.000	2.243		MIC	CNC-04
	2.180	+0.005/-0.000	2.182.			
	2.180	+0.005/-0.000	2.184			
	2.237	+0.005/-0.000	2.241			
	2.272	+0.005/-0.000	2.277			
	2.306	+0.005/-0.000	2.310			
	2.339	+0.007/-0.000	2.346			
	2.339	+0.007/-0.000	2.346			
	0.062	+/-0.010	.062			
	4.26	+/-0.030			↓	↓
	R0.063	+/-0.010	.063		R6	—
	R0.50	+/-0.030	.50		R6	—
110.27	+/-0.060	110.25			tape	L6-22

Measured by:	MM.C/	Audited by:	JW	Preliminary Approval:	
Date:	12/09/24	Date:	12-9-26	Date:	

Rev	Date	Change	Revised by	Approved
A	06.11.09	New Issue (P/O D350-748-101)	KJ/JLM	
B	07.10.24	Dwg Rev updated	KJ/EC/DD	
C	11.01.20	Dwg Rev updated	KJ	
D	11.07.26	Tolerance revised for 2.339 dimensions	KJ	MM

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_  
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NOTE: Date & initial all entries

Item	Qty	Part Number	Description
1	X	D350-748-141	CROSSTUBE ASSEMBLY (AS 350/355 HI FWD)
2	1	D6015-125	CROSSTUBE (OR D6017-115)
3	2	D3502-1	SUPPORT
4	2	D2856-400-710	ABRASION STRIP
5	1	AELS-1032-225	INSERT
6	1	NAS1149D0363J	WASHER (OR AN960JD10)
7	2	MS21920-20	CLAMP (PER DART SPEC. M-MS21920-20)
8	1	MS27039-1-10	SCREW

GENERAL NOTES:

- F 1) MATERIAL: MANUFACTURED FROM D6015-125 OR D6017-115  
FINISHED LENGTH = 110.270±0.06
- F 2) FINISH: MAGNETIC PARTICLE INSPECT PER DART QSI 038 4.2  
CADMIUM PLATE PER AMS-QQ-P-416B, CLASS 1, TYPE II  
PRIME INSIDE AND OUTSIDE PER DART QSI 005 4.2  
PAINT OUTSIDE PER DART QSI 005 4.2
- F 3) TOLERANCES ARE PER DART QSI 018 UNLESS OTHERWISE NOTED.
- F 4) UNITS: INCHES UNLESS OTHERWISE NOTED.
- F 5) BREAK SHARP EDGES: 0.005 TO 0.010 MAX.
- F 6) IDENTIFICATION: DART PART NUMBER "D350-748-141" AND BATCH NUMBER ON INSIDE OF CUFF  
PER DART QSI 044 6.4 (VIBRATING STYLUS)
- F 7) WEIGHT: 30.45 lbs
- F 8) PART IS SYMMETRIC ABOUT CENTERLINE, EXCEPT FOR Ø0.297 HOLE.
- F 9) BLEND OUT ALL EDGES FROM MACHINING LONGITUDINALLY, TRANSITION SHOULD BE SMOOTH.  
NOTE: ALL HOLES ARE DRILLED AFTER BENDING.
- F 10) BEND PROGRESSIVELY WITH A MINIMUM OF 7 PASSES. MAXIMUM TUBE FLATTENING DUE TO  
BENDING IS 6% BASED ON O.D.
- F 11) HEAT TREAT TO MIN. 180 KSI PER MIL-T-6736 OR AMS 2759-1C AFTER TURNING. ACCEPTABLE TO  
VERIFY TENSILE STRENGTH BY HARDNESS TEST PER ASTM E18 TO 40-45 HRC.
- F 12) INSTALL D2856-400-710 ABRASION STRIPS WITH A GAP ON BOTTOM SIDE OF CROSSTUBE,  
CENTERED OPPOSITE D3502-1 SUPPORT. PER QSI 035.
- F 13) EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE  
OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES,  
NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY.  
CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE. WHEN DRILLING HOLES EXTREME CARE  
MUST BE TAKEN AND CAREFUL DEBURRING PERFORMED TO ENSURE A CLEAN HOLE WITH NO  
CRACKING/CHIPPING/GROOVES.
- F 14) TORQUE CLAMPS 60 TO 80 IN-LB. ENSURE AT LEAST 1.5 THREADS SHOWING IN SAFETY AND THAT  
NUT HAS NOT BOTTOMED-OUT AFTER TORQUING.
- F 15) MAX TWIST AFTER BENDING. WITH XTUBE LAYED FLAT ON SURFACE, THE DIFFERENCE BETWEEN  
CUFF HEIGHTS FROM THE SURFACE MAY BE NO LARGER THAN 0.25 (ZN C1-3).

SHOP COPY

RETURN TO

ENGINEERING

UNCONTROLLED COPY

SUBJECT TO AMENDMENT

WITHOUT NOTICE

WORK ORDER

NO. 84604 MLJ

12/05/31

UNDER REVIEW

11/07/12

RELEASED  
2011-01-18  
AM

F	ADD HRC TEST OPTION (B8-1) PER PAR 09-040, ADD TWIST LIMIT (A8-1, C1-3), ADD D6015-125 OPTION (C8-1), STOCK DIM NOW MACHINED (D1-4)	CP	10.11.23
E	REVISE GENERAL NOTES; UPDATE TO CURRENT ADD STANDARDS; RELOCATED FLAG #6 PER PAR 08-046 (ZN A6-3); TOLERANCES (ZN C6-3, D1-3)	RF	09.09.30
D	MAG. PARTICLE AND CAD PLATING AS MFD.	CP	06.10.31
C	ADD CAD PLATING	CP	06.08.14
B	ADD D6017-115 & PRIME AND PAINT	CP	06.06.30
A	NEW ISSUE	CP	06.03.31
REV.	DESCRIPTION	BY	DATE
DESIGN	<i>PP</i>	DART AEROSPACE LTD HAWKESBURY, ONTARIO, CANADA	
DRAWN	<i>PP</i>		
CHECKED	<i>PP</i>	DRAWING NO.	REV. F
MFG APPR.	<i>PP</i>	D350-748-141	SHEET 1 OF 4
APPROVED	<i>PP</i>	TITLE	SCALE
DE APPR.	<i>PP</i>	CROSSTUBE (AS 350/355 HI FWD)	NTS
DATE	10.11.23	COPYRIGHT © 2006 BY DART AEROSPACE LTD THIS DOCUMENT IS PROPRIETARY AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR DISCLOSED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD	

W/O:		WORK ORDER CHANGES							
DATE	STEP	PROCEDURE CHANGE			By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

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NOTE: Date & initial all entries

8 7 6 5 4 3 2 1

D

D

C

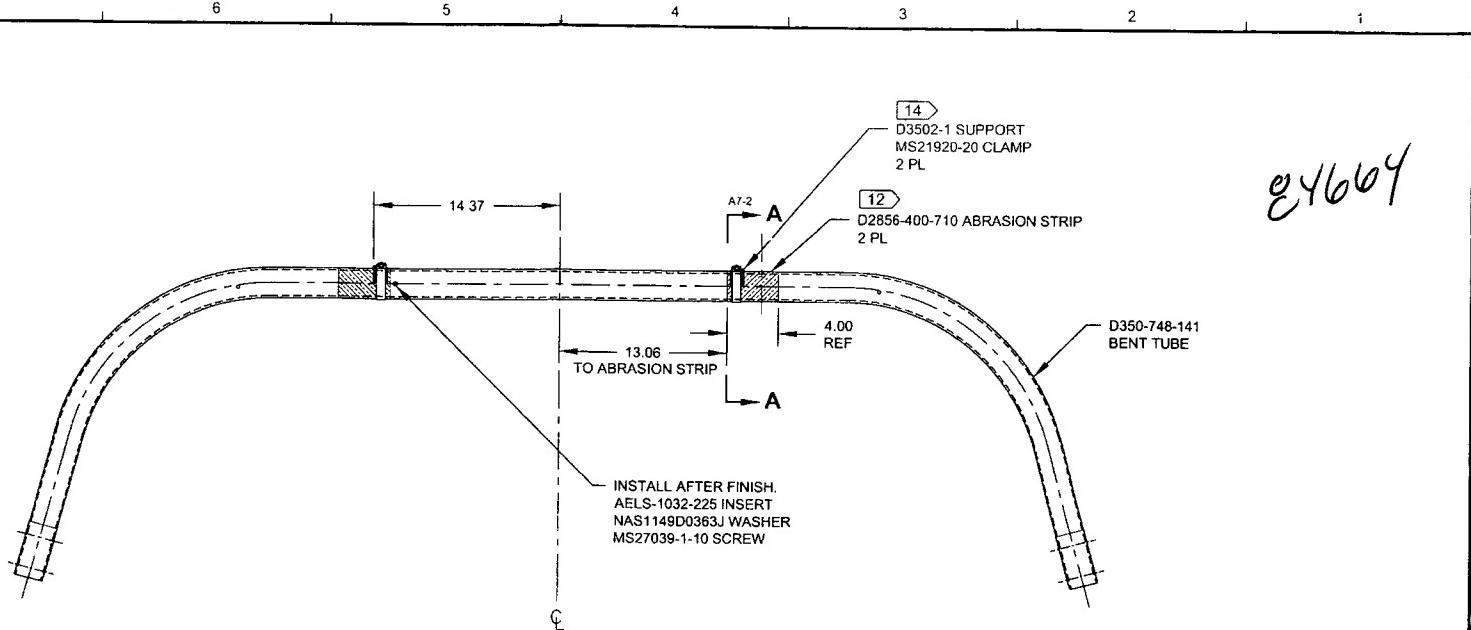
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B

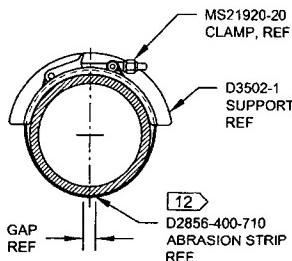
B

A

A



D350-748-141  
ASSEMBLY DETAIL



SECTION A-A D4 2  
SCALE 4X

UNDER REVIEW  
Q11.07.11

RELEASED  
2011-01-18  
M

DESIGN	99	DART AEROSPACE LTD
DRAWN	99	HAWKESBURY, ONTARIO, CANADA
CHECKED	1	DRAWING NO
MFG. APPR	12	D350-748-141
APPROVED	10	TITLE
DE APPR	10	SCALE
DATE	10.11.23	CROSSTUBE (AS 350/355 HI FWD)
		NTS

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8 7 6 5 4 3 2 1

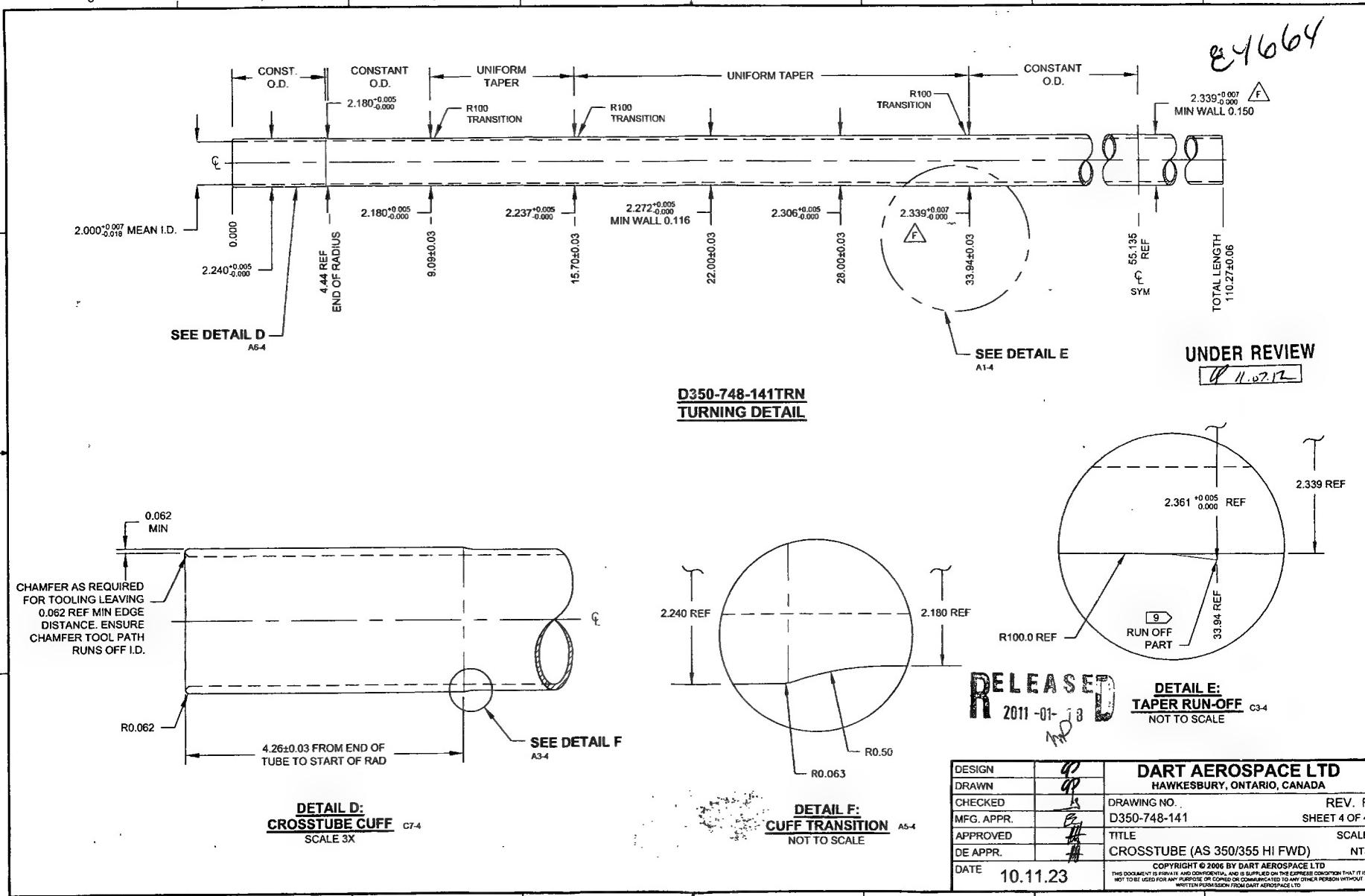
W/O:		WORK ORDER CHANGES						
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Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

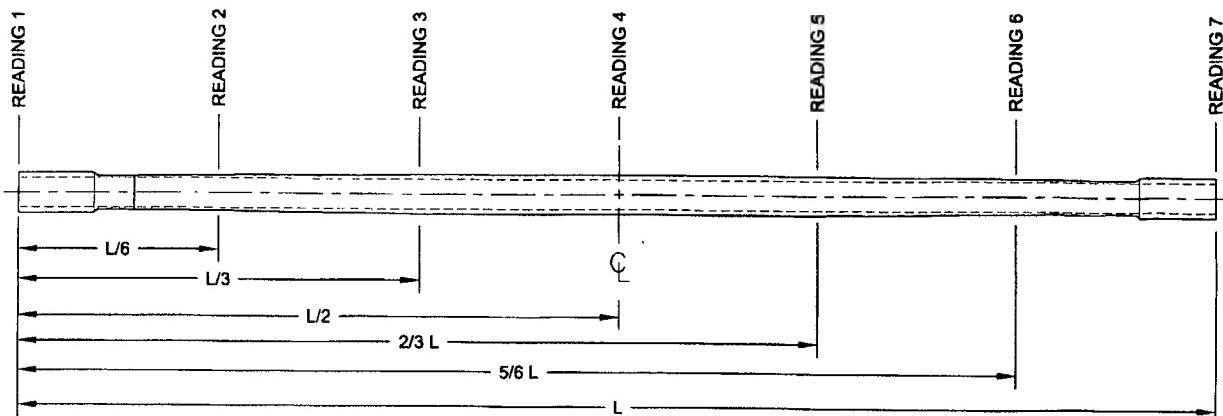
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			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

NOTE: Date & initial all entries

DART AEROSPACE LTD	Work Order:
Description: Crosstube Assembly (AS350/355 High Fwd)	Part Number: D350-748-141
Inspection Dwg: D350-748-141 Rev: F	Page 2 of 2

### WALL THICKNESS MEASUREMENT



Location	WALL THICKNESS MEASUREMENT (IN)				Deviation $\Delta w$ (max-min)	TOLERANCE
	w1	w2	w3	w4		
READING 1 L = 0"	.125	.119	.123	.132	.013	
READING 2 L = 18.2	.145	.131	.119	.130	.016	
READING 3 L = 37.37"	.194	.171	.161	.184	.033	
READING 4 L = 55	.180	.175	.174	.181	.007	
READING 5 L = 37"	.172	.174	.183	.181	.011	
READING 6 L = 18.2	.136	.119	.123	.139	.020	
READING 7 L = cuff	.119	.121	.128	.124	.009	

#### Calibration Result

Actual Block Thickness: 100-300

Sitescan 250 Measured Thickness: 100-200

Measured by:	KC	Audited by:	JW	Preliminary Approval:	
Date:	12-9-25	Date:	12-9-26	Date:	

Rev	Date	Change	Revised by	Approved
A	06.11.09	New Issue (P/O D350-748-101)	KJ/JLM	
B	07.10.24	Dwg Rev updated	KJ/EC/DD	
C	11.01.20	Dwg Rev updated	KJ	
D	11.07.26	Tolerance revised for 2.339 dimensions	KJ	
E	12.06.04	Wall thickness form added	KJ	

B  
E. MERMAID LANE  
WYNDMOOR, PA 19038

acking List

Sales Order Number:

74295

Sales Order Date

Oct 16, 2012

Page:

1

Voice: 215-233-2600  
Fax: 215-233-5653

Sold To:

DART AEROSPACE  
1270 ABERDEEN STREET  
HAWKESBURY, ON K6A 1K7

Ship To:

DART AEROSPACE  
1270 ABERDEEN STREET  
HAWKESBURY, ON K6A 1K7

Customer ID	PO Number	Payment Terms
DARA	PO18083	Net 30 Days
Ship Via	Process	
	CALL CUSTOMER	HT

Quantity	Item	Description	Total Shipped	This Shipment
16.00	EACH	E350-748-141TRN CROSSTUBE HEAT TREAT TO MIN 180 KSI (MIL-T-6736 OR AMS 2759-1C) SANDBLAST TUBE AFTER HEAT TREAT 260 POUNDS TOTAL		
1.00	CERT.			

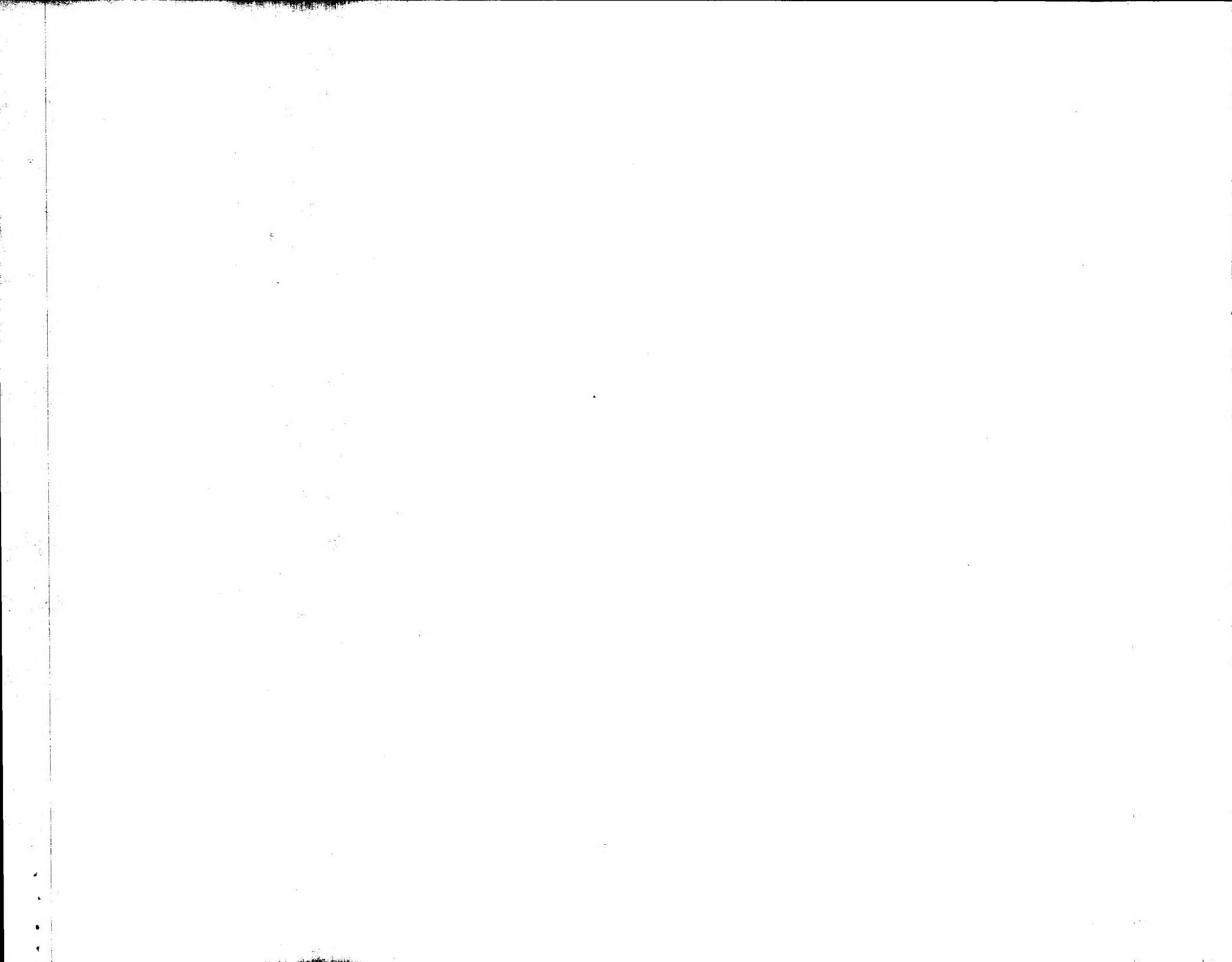
COMMENTS

SHIPPED BY, SIGNATURE  
METLAB

DATE

RECEIVED BY, SIGNATURE  
DART AEROSPACE

DATE





1000 E. Mermaid Ln., Wyndmoor (Phila.) PA 19038-8093  
Tel. (215) 233-2600 Fax (215) 233-5653

## Certification

### SOLD TO

Dart Aerospace Ltd.  
1270 Aberdeen Street  
Hawkesbury, ON K6A 1K7

November 13, 2012

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**Metlab Shop Order No:** 74295  
**Purchase Order:** P018083  
**Description:** Crosstube  
**Part No.:** E350-748-141TRN  
**Quantity:** 16 Pieces  
**Weight:** 260 Pounds  
**Material:** 4130 Alloy Steel  
**Specifications:** Heat Treat to Minimum 180 KSI (MIL-T-6736 OR AMS 2759-1C).  
Sandblast tube after heat treat.

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This is to certify that the above parts were processed as indicated above and conform to the specification requirements.

### Results:

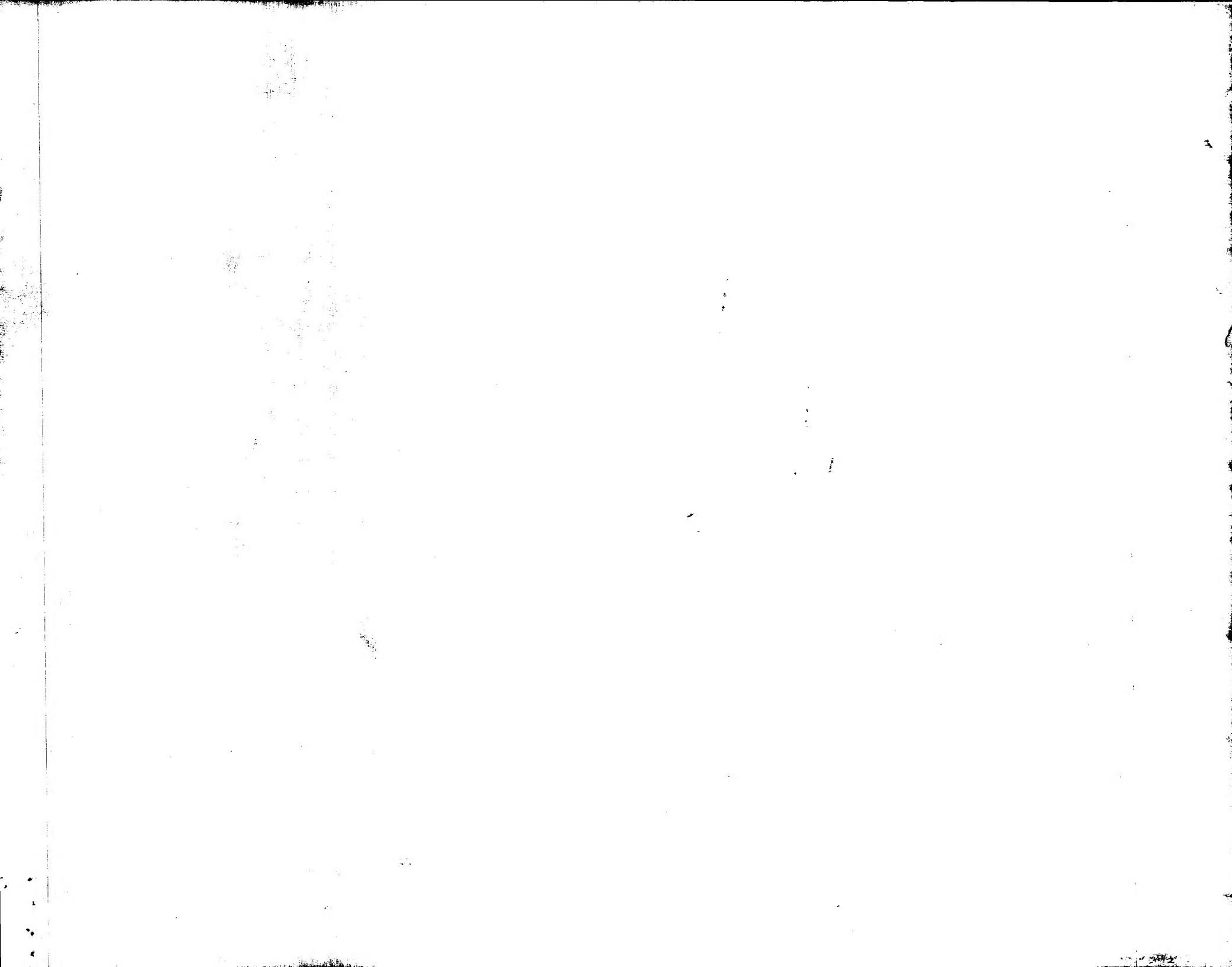
Hardness: HRC 40-42 (180-192 ksi converted)

METLAB \_\_\_\_\_  
Quality Representative J.G. Conybear

MERCURY CONTAMINATION: During the heat treating process, testing and inspections, the product did not come in direct contact with mercury or any of its compounds nor with any mercury containing device.



Heat Treating and Metallurgical Consulting



# D 350 X-TUBE CUFF MEASURMENTS

## AFTER HEAT TREATING

TYPE	BATCH #	SIDE A	SIDE B
		TWO READINGS	TWO READINGS
1    AFT	90671	2.251"/20238"	2.238"/2.243"
2    AFT	90670	2.235"/2.247"	2.236"/2.250"
3    AFT	90675	2.220"/2.261"	2.235"/2.257"
4    AFT	90672	2.239"/2.264"	2.240"/2.242"
5    AFT	90676	2.238"/2.240"	2.247"/2.254"
6    AFT	90674	2.238"/2.245"	2.242"/2.258"
7    AFT	90688	2.239"/2.251"	2.238"/2.247"
8    AFT	90677	2.242"/2.247"	2.238"/2.256"
9    AFT			
10   AFT			
11			
12   FWD	84664	2.234"/2.249"	2.209"/2.274"
13   FWD	86273	2.227"/2.261"	2.195"/2.258"
14   FWD	84665	2.239"/2.245"	2.214"/2.276"
15   FWD	84654	2.210"/2.275"	2.246"/2.249"
16   FWD	84661	2.246"/2.254"	2.193"/2.287"
17   FWD	84663	2.212"/2.272"	2.247"/2.252"
18   FWD	86272	2.266"/2.212"	2.243"/2.253"
19   FWD	84662	2.209"/2.269"	2.242"/2.254"
20   FWD			
21   FWD			
22   FWD			
23   FWD			